

ever this may be, the initial whirl is, we suppose, always due to the systematic deflection of inblowing winds by the diurnal rotation of the earth.—C. A.

SOME EXPERIMENTS IN ATMIDOMETRY.

By JAMES S. STEVENS, Professor of Physics, University of Maine, dated February 25, 1902.

An attempt has been made at the University of Maine to establish a course in meteorology. The course includes both class-room and laboratory work. In connection with this work certain experiments in evaporation were assigned to a student, Miss M. C. Rice, the results of which are embodied in this paper. Very little originality is claimed for the methods and no new results have been obtained, but it was thought that some of the conclusions reached might prove of interest to workers in this field.

The principal object of the experiments was to compare the relative rates of evaporation of certain liquids under different conditions of temperature, surface, wind velocity, etc. Two Babington's atmimeters (A and B) were employed, one of which is shown in fig. 1.

The scale divisions on each instrument were carefully calibrated, and the following constants determined:

A, 15.4 grams per division; B, 25.3 grams per division.

That is to say, it required these masses to be placed in the upper pan to depress each stem through one scale division. It is obvious therefore that the total evaporation in the pan of A which would cause a rise of one division, would be equivalent to 15.4 grams.

The pans used had slightly different diameters, so that the surface areas exposed were as follows: A : B :: 7.1 : 6.2. The areas are expressed in square centimeters.

The observations were made by filling the pans with the liquids to be tested, then focusing the cross wire of a telescope on a certain division on the scale, and noting the rise due to evaporation in given intervals. That the evaporation rates were fairly constant is shown by the figures in Table 1 and curves [curves omitted] which give an idea of the nature and results of the experiments with ether and alcohol. The time interval was five minutes, and there are recorded the corresponding scale readings, the rise due to evaporation and the equivalent in grams for each liquid. Both these sets of observations were made simultaneously. When the surface of B is reduced to the same dimensions as that of A it is seen that ether evaporates nearly ten times as rapidly as alcohol.

In Table 3 the conclusions of a series of observations similar to those in Table 1 are given. The temperature, pressure, and relative humidity were kept fairly constant. Expressing these results relatively, water being taken as unity, we have the following: Water, 1.0; alcohol, 3.2; carbon bisulphide, 8.8; ether, 28.8; chloroform, 40.0.

In Table 3 a comparison is made of the relation of evaporation to the extent of surface. If we multiply the evaporation of A by the surface of B it should equal the evaporation

of B multiplied by the surface of A. Our result gives 0.248 and 0.247, respectively, which shows that within the limits of the accuracy of the experiment evaporation is proportional to the extent of the surface.

TABLE 1.—Ether and alcohol.

Periods.	Ether, A.			Alcohol, B.		
	Readings.	Differences.	Grams.	Readings.	Differences.	Grams.
<i>h. m.</i>						
1:51.....	2.8			6.6		
56.....	9.2	6.4	0.41	7.5	0.9	0.03
2:01.....	15.3	6.1	0.39	8.5	1.0	0.03
06.....	20.9	5.6	0.36	9.4	0.9	0.03
11.....	26.9	6.0	0.38	10.4	1.0	0.03
16.....	32.7	5.8	0.37	11.6	1.2	0.04
21.....	37.8	5.1	0.32	12.5	0.9	0.03
26.....	42.9	5.1	0.32	13.6	1.1	0.04
31.....	48.4	5.5	0.36	14.8	1.2	0.04
36.....	54.8	5.4	0.35	15.7	0.9	0.03
41.....	60.5	5.7	0.37	16.7	1.0	0.03

Mean, A, 0.36. Mean, B, 0.033. B reduced to surface area of A = 0.038. Temperature, 23.0° C. Pressure, 758.9 mm. Relative humidity, 42 per cent.

TABLE 2.—Conclusions from experiments with various liquids.

Liquids.	Periods.	Evaporation ratios.	Temperature.	Pressure.	Relative humidity.
	<i>Minutes.</i>		<i>°C.</i>	<i>Mm.</i>	<i>%</i>
Water and alcohol.....	10	0.024 : 0.08	24.7	748.5	41
Chloroform and carbon bisulphide.	1	0.10 : 0.022	23.3	753.8	50

TABLE 3.—Comparison of surface areas. Chloroform.

Periods.	Readings.	Differences.	Grams, A.	Readings.	Differences.	Grams, B.
<i>h. m.</i>						
9:58.....	3.0			1.0		
59.....	4.5	1.5	0.05	1.5	0.5	0.032
10:00.....	5.5	1.0	0.03	2.0	0.5	0.032
01.....	6.8	1.3	0.05	2.4	0.4	0.026
02.....	7.8	1.0	0.03	3.1	0.7	0.045
03.....	8.9	1.1	0.04	3.8	0.7	0.045
04.....	9.9	1.0	0.03	4.4	0.6	0.039
05.....	11.0	1.1	0.04	4.9	0.5	0.032
06.....	12.0	1.0	0.03	5.4	0.5	0.032
07.....	13.3	1.3	0.05	5.8	0.4	0.026
08.....	14.8	1.5	0.05	6.4	0.6	0.039

Mean, A, 0.040. Mean, B, 0.0348. Ratio of surfaces, 7.1 : 6.2. Temperature, 16.6° C. Pressure, 769.9. Relative humidity, 45 per cent.

Table 4 indicates that the relative evaporation of liquids is approximately constant, and is independent of the velocity of the wind over the exposed surface. In the above work the temperature was different under the two conditions by an average of about 12° C. It was determined that in the case of ether a difference of 1° C. corresponded to a difference of about 0.001 gram per minute.

TABLE 4.—Rate of evaporation with and without wind.

Liquids.	Evaporation per minute (no wind).	Velocity of wind, feet per minute.	Corresponding evaporation.
Alcohol.....	0.007	188	0.03
Chloroform.....	0.04	200	0.16
Ether.....	0.072	220	0.28

[NOTE.—In the interest of meteorology it is to be hoped that the author will extend these observations so as to include sea water and fresh water of different temperatures, as also snow and ice, so that we may have some idea of the relative evaporations on different portions of our globe.—C. A.]

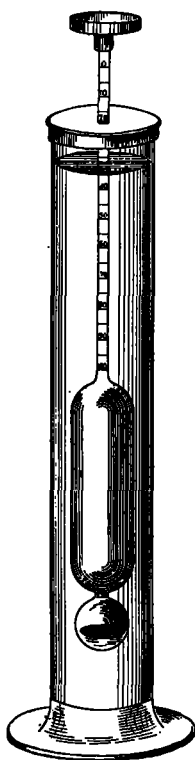


FIG. 1.—Babington's atmimeter.